

Original Research

Evaluating the relation between the elongated styloid process and the ponticulus posticus using cone-beam computed tomography

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ABSTRACT:

Background: To assess the correlation between the elongated styloid process and the ponticulus posticus using cone-beam computed tomography. **Materials & Methods:** A cohort of 50 subjects participated in the study, evenly distributed between 25 females and 25 males. Specifically, the case group encompassed 8 females and 13 males, while the control group consisted of 17 females and 12 males. The resulting dataset underwent analysis utilizing the SPSS software for further insights and conclusions. **Results:** Patients with ESP and PP had a higher average age compared to the control group. The cases involving bilateral ESP and PP had the highest average age at 40.05 years. **Conclusion:** There was no significant relationship between ESP and PP.

Keywords: styloid process, ponticulus posticus.

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INTRODUCTION

The name styloid process (SP) was derived from the Greek word “stylos” meaning a pillar. The SP is a cylindrical, thin, slender bony projection which arises from the posterior part of the lower surface of the petrous part of the temporal bone immediately in front of the stylomastoid foramen.^{1,2} The process is directed downward to the front and slightly medially. The ligament represents from embryological view the continuation of the apex of SP. All the above the entire previous mentioned features constitute the stylohyoid chain. The whole chain derives embryologically from four cartilages: tympanohyal, stylohyal, ceratohyal, and hypohyal. The SP originates from the second branchial arch.³ Elongated SP (ESP) may be one of the causes annoying orofacial pain. Eagle's syndrome develops unilaterally or bilaterally, and more uncommonly when an ESP or calcified stylohyoid ligament causes recurrent throat

pain, dysphagia, pain on opening the mouth and during chewing, or facial pain.⁴ The ponticulus posticus is an anatomical variation of the dorsal part of the atlas vertebra and is closely associated with the course of the vertebral artery.⁵ The bony spicules cover the groove of the vertebral artery and may arise from either the superior articular facet or the posterior arch of the atlas, or from both sites. The spicules may approximate each other up to complete fusion. Ponticulus posticus is not rare: a large computed tomographic study on the cervical vertebral column revealed a prevalence of ponticulus posticus of 15.6%, but others found lower and higher prevalence rates.⁶⁻⁸ Hong et al. also described ponticulus posticus as a slightly more frequent phenomenon in males, but this finding was not confirmed by other studies.⁶ The classification of the ponticulus posticus is based on the origin and number of spicules and the eventual fusion of two processes into a complete bridging,

forming the 'arcuate foramen' as a result of fusion, a term synonymously used for ponticulus posticus.⁹ Bilaterally converging spicules or complete bridging accounted for more than 75% of posterior ponticuli, but it is likely that both the prevalence of ponticulus posticus and the frequency of different ossification types relies on the research method applied in the particular study.^{10,11} The classification of ponticulus posticus works on the basis of analyzing lateral views of the cervical vertebral column, one preferential projection in the fields of anthropometry and craniofacial diagnosis.^{6,12} However, in the recent past, three-dimensional (3-D) cone-beam computerized tomography (CBCT) which can definitively measure the length of the anatomical structures of craniofacial region is introduced as a new and alternative modality.¹³ CBCT allows images to be acquired with a low dose of radiation, shorter patient examination time and lower costs than conventional CT, which make its routine use practicable for oral and maxillofacial imaging and surgical procedures. This recently-designed technology has become a relevant tool for diagnostic imaging of oral and maxillofacial osseous structures, providing to professionals access to excellent image quality and greater diagnostic accuracy and sensitivity.¹³ The treatment of ES is primarily surgical through an intraoral or extraoral approach.^{14,15} Nonsurgical treatments include reassurance, non-steroidal anti-inflammatory medications, analgesics, anticonvulsants, antidepressants and local infiltrations with steroids or anesthetic agents.¹⁶ Patients who fail medical therapy may benefit from surgical removal of the elongated

portion of the SP. Hence, this study was conducted to assess the correlation between the elongated styloid process and the ponticulus posticus using cone-beam computed tomography.

MATERIALS & METHODS

A cohort of 50 subjects participated in the study, evenly distributed between 25 females and 25 males. This group was subsequently categorized into case and control subgroups. Specifically, the case group encompassed 8 females and 13 males, while the control group consisted of 17 females and 12 males. The age range for inclusion was set between 20 to 65 years. Comprehensive CBCT examinations were conducted, accompanied by thorough historical data collection. The analysis centered on the elongated styloid process and the ponticulus posticus, considering factors such as age and gender. Relevant data was meticulously gathered for these assessments. The resulting dataset underwent analysis utilizing the SPSS software for further insights and conclusions.

RESULTS

The research involved 25 women and 25 men as participants. The average age was 37.24 years. The research explores the examination of PP and ESP in patients based on their average age and gender. Patients with ESP and PP had a higher average age compared to the control group. The cases involving bilateral ESP and PP had the highest average age at 40.05 years. In terms of gender, there was no noteworthy distinction between males and females.

Table: Analysis of prevalence of the elongated styloid process (ESP) and ponticulus posticus (PP) acc. to age and gender

	ESP				PP			
	Female	Male	Mean age	Std. deviation	Female	Male	Mean age	Std. deviation
Absent	12	14	33.4	14.482	5	3	37.12	11.042
Present	6	7	38.42	9.205	2	1	39.02	11.125

DISCUSSION

The patients having ES have often been treated by family physicians, otolaryngologists, neurologists, neurosurgeons, dentists, maxillofacial surgeons, and psychiatrists. However success is very little, because clinicians frequently fail to diagnose ES. The misdiagnosed patients with ES may undergo unnecessary treatments and surgical procedures.¹⁵ Thus, a correct differential diagnosis is crucial to distinguish elongated SP from other situations with partially overlapping symptoms. The differential diagnosis for ES includes cervical myofascial pain syndrome, migraine, trigeminal neuralgia, glossopharyngeal neuralgia, nervus intermedius neuralgia, nasopharyngeal mass/lesion, tonsillitis, otitis, degenerative diseases causing neck pain, psychosomatic diseases, vascular compromise

(atherosclerosis), pain of dental origin, and TMJ problems.¹⁵ Hence, this study was conducted to assess the correlation between the elongated styloid process and the ponticulus posticus using cone-beam computed tomography. In the present study, research involved 25 women and 25 men as participants. The average age was 37.24 years. The research explores the examination of PP and ESP in patients based on their average age and gender. Patients with ESP and PP had a higher average age compared to the control group. A study by Shahidi S et al, determine the relationship between elongated styloid process (ESP) and PP in a group of Iranian patients using cone-beam computed tomography (CBCT) images. The CBCT images of 349 patients (118 males and 231 females; mean age: 32.53 ± 14.143) were involved in this study. The atlas vertebra was investigated for the

presence and classification of PP (partial or complete) in sagittal views. Also, the styloid process was evaluated for the presence of ESP in reconstructed panoramic and three-dimensional images. Data were analysed using Mann-Whitney test, Fisher's exact test, and Chi-square test to assess the relationship between the presence of PP and ESP with regard to age and gender. Ponticulus posticus was observed in 24.5% of patients with ESP and 31.98% of patients without ESP. There was no significant relationship between the presence of PP and ESP ($p = 0.198$). Twenty-five patients with ESP showed PP; cases of ESP with either side and opposite side PP were 7.84% and 1.96%, respectively. Cases of bilateral ESP and PP were predominant (14.70%). The mean age of patients with bilateral ESP and PP was higher than others. There was no significant difference between males and females ($p = 0.456$). Considering the prevalence and characteristics of PP in the case and control groups, there was no significant relationship between PP and ESP.¹⁷

In the present study, patients with ESP and PP had a higher average age compared to the control group. The cases involving bilateral ESP and PP had the highest average age at 40.05 years. In terms of gender, there was no noteworthy distinction between males and females. Another study by Sekerci AE et al, the presence or absence of the PP (whether partial or complete) was determined and noted as a positive or negative finding. Then, the patients with PP were evaluated for ESP. For this purpose, 3-D CBCT scanning digital images of 542 patients having ESP (247 males and 295 females) were examined retrospectively. There was a significant relationship between the presence of PP and ESP ($P=0.03$). The results suggest that there is a significant correlation between the presence of PP and ESP.¹⁸ Langlais et al.¹⁹ proposed a classification of the radiographic appearance of elongated and mineralized ESP based on three types of complexes including Type I, Type II, and Type III. This classification was used in a few studies. Ilgüy et al.²⁰ evaluated 860 panoramic radiographs and they observed that 32 patients (3.7%) have ESP. Among of 32 patients, Type I (elongated) was found the most frequent type of SP on both sides. In another study, the panoramic radiographs of 55 adults were analyzed by Kursoglu et al.²¹ Type I was observed most frequently in the study. Similarly, our report confirms that Type I (elongated, SP is characterized by uninterrupted integrity of the image) was the most frequent type. Oztunç et al.²² was evaluated CBCT records of 208 patients, and out of 208 patients, 112 (54%) had ESP. Contrary, Type II was observed the most frequently in that study. The prevalence of elongated and symptomatic SP is not exactly known since different length values were reported in the studies. The reason for different variations in the measurements of SP in various studies could be the difference in imaging methods. The assessment of the length of SP might be effected

by the magnification of the panoramic devices and by the angulations of the SP in 2D imaging technology. Moreover, symptoms also depend on the angulation of SP as well as length.²³ These parameters can only be measured by advanced imaging techniques exactly. When the angle of SP is narrow, it may be supposed to produce some complaints due to compression of adjacent structures.

CONCLUSION

There was no significant relationship between ESP and PP.

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